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EVALUATION OF DATA GENERATOR FOR THREAD/PROGRAM UNIT TESTING.(U)
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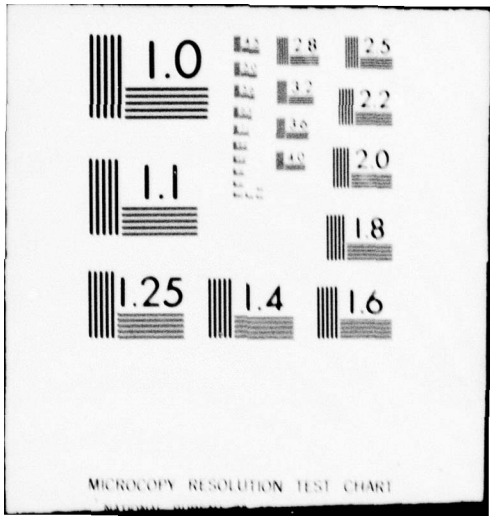
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TECHNICAL REPORT T-78-64

EVALUATION OF DATA GENERATOR FOR THREAD/PROGRAM UNIT TESTING

U.S. ARMY MISSILE RESEARCH AND DEVELOPMENT COMMAND

Charles L. Lewis, Farley W. Spruell, Wayne L. Jones
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Technology Laboratory

Redstone Arsenal, Alabama 35809

26 June 1978

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report documents the results of a study to determine the feasibility of utilizing actual field test data or other hardware related test data stored on Mission Recording Tapes (MRT's) to develop an Environment Generator (ENVGEN) data set for WCC software testing. Two representative program units (BIDR and SAPB) were evaluated. Results indicated that while some programs units can be successfully tested with MRT-based ENVGEN data (i.e., SAPB), the wide variations in data collected on MRT's and the input requirements of the various

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threads/program units make it unfeasible to develop a computer porgram which automatically creates the ENVGEN data set. MRT data retrieval and SAPB software test computer program listings are included.

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1. INTRODUCTION

Utilizing actual field test data or other hardware related test data as the driver for computer software testing represents a logical way to determine the software's performance under realistic conditions. For the PATRIOT Missile System, this would constitute extracting data from Mission Recording Tapes (MRT's) and reformatting it into an Environment Generator (ENVGEN) data set. This report documents the results of a study in which two representative program units (BIDR and SAPB) were evaluated to determine the feasibility/problems associated with developing and applying this type of test tool.

2. GENERAL OBSERVATIONS OF K-6 DATA COLLECTION

MRT data collection is designed primarily to verify real time mission test performance. The amount of data collected is limited by tape write speed. The data collection capability was never expected to be all-inclusive, with every WCC software parameter being printed out every program pass.

In addition, changing requirements for each mission result in different amounts and type of data being taken, both from mission to mission and within each mission. For example, during a test where actual missile intercept of a target is the objective, MRT data would naturally be concentrated on the guidance phases of operation and the WCC parameters affecting guidance. Conversely, for tests primarily involving acquisition and track of targets in a complex environment, MRT data taking will be concentrated on the search and track modes of the test.

These wide variations in data collected on MRT's and the diverse input requirements of the various WCC threads/program units would intuitively preclude any development of a general purpose, computer program designed to automatically extract data from a MRT and reformat the data for use in the ENVGEN data base for utilization as a test tool with the WCC simulator. This observation is further supported by an examination of the MRT data collection points scattered throughout the WCC software. In general, any thread/program unit of interest may have data collected prior to entry and/or also after exit for each pass through the WCC software. In order to create a test ENVGEN data representing a single instant of real time, data taken after exit from the thread/program unit of interest must be used as input for the next pass through the unit. Since a typical

thread/program unit will have some data taken before and after a pass through the unit, proper temporal mixing of the MRT data for reformatting a test input tape must be done on a program unit by program unit basis. Again, this indicates more of a case-by-case manual data gathering and compilation of any MRT based ENVGEN data sets, with any automatic computer program development to do this being too large and complex to be cost effective.

3. STUDY RESULTS

The Beam Interference Detection and Response (BIDR) and Select Autopilot Band (SAPB) program units were examined as possible candidates for testing with a MRT generated ENVGEN data base. The program unit BIDR, which maintains effective radar search beam utilization in presence of interference, and assists in locating targets marked by this interference, is relatively complex, with many options, etc., and requires a diverse array of input data for proper operation. On the other hand, the guidance system program unit SAPB, which selects the missile autopilot band and the maximum allowable missile lateral acceleration, is considerably less complex than BIDR with straight-forward input and initialization requirements. Noting the methods, difficulties, etc., encountered in the effort to develop MRT based ENVGEN data base test tapes for these program units should reveal the major considerations necessary for most other threads/program unit.

A. Program Unit BIDR Evaluation Results

The required inputs for BIDR was obtained from the FCG-2 Search Functional Specification[1] *Table 1.* These input requirements were compared with the MRT data collection modes and other conditions/constraints shown in the K6 data collection table[2] *Table 2.* The COMPOOL set/use tables were utilized to determine which of the required BIDR inputs were constants and thus unchanged from the basic ENVGEN data load and which were program variables whose values could change, and therefore, after program initiation must be supplied from a MRT.

The breakdown of BIDR input data into applicable MRT data collection

1. Draft FCG-2 Search Functional Specification, ASD-7504, Raytheon Corp., Bedford, Mass., December 31, 1975 (Unclassified)

2. ASD-10274, Attachment 1, Raytheon Corp., Bedford, Mass., 3 August 1977 (Unclassified)

TABLE 1. BIDR INPUT REQUIREMENTS

Inputs required by BIDR are listed, grouped according to the file or record in which they appear.

Search beam record:

- MOCK - monitor clock
- BMDG - beam degraded indicator
- BONOFF - beam on-off indicator
- BNUM - beam number
- CNUM - column number
- RGS - receiver gain state
- BRRAMΦ - first word of the BRRAM (wordΦ)
- CSC - control sidelobe cancellation
- beam record RAM copied into the RIB

CFAR Alarm Test Variables Table (part of beam record)

CFC1 through CFC4 - beam-dependent CFAR comparison variables.

RDR:
- FTYPE - functional type of the radar action
- RTYPE - radar action type
- MCTIME - major cycle time of the radar action being processed
- NSCH - number of unsuccessful attempts to schedule the request
- RSCTR - sector identification
- RAM - address of the related beam record RAM
- various items copied into the output RDR

RAM (input RAM for the environment action):

- R1RAMΦ - first word of the input RAM (word Φ)
- RRAT1 - radar action time, fraction of a major cycle
- various items copied into the output RAM
- entire RAM copied for ALPR

RRM:
- NRW1 - number of remaining words in the RRM
- NREG1 - contents of the N-register
- CFAR11 through CFAR41 - CFAR alarm indicators
- SB11 through SB41, SEML11 through SEML41, GB11 through GB41, GEML11 through GEML41, COIN11 through COIN41 - interference indicators
- PTRNG - point range of alarms (copied for ALPR)

TABLE 1. (Continued)

SRPTBL (Search RTYPE Parameters Table):
- SBLNZ - search bottoming level for non-zero PFA
- SSDCNZ - search SPG detection control for non-zero PFA (PFA = 10^{-6})
- RMINRC - minimum instrumented range in range cells
- SBLZ - search bottoming level for zero PFA
- SSDCZ - search SPG detection control for zero PFA
- GBC - guard band blanking control
- SLBOFS - sidelobe blanking offset in range cells (constant part of SRP11)

RAP (Track RTYPE Parameters Table):
- RAP11 - SPG detection control for PFA = 10^{-3}
- RAP18 - maximum instrumented range

Surveillance State File:
- SCPEN - state control parameter-frequency diversity enabled

ILD Logic Constants Table:
- CMC1 through CMC7 - IID logic constants

CFAR Alarm Test constants Table:
- CFC1S through CFC4S - beam-independent CFAR comparison constants

Radar Load Table:
- RLT - radar load counts

Search RTYPE Inhibit Table:
- SRTINT - RTYPE-enabled indicators (complement of the DPSR form)

Beam Monitor Count Table:
- MOCKC - initial counts for the monitor clock

BIDR Constants Table:
- BC1 through BC6 - constants used by BIDR

RIB auxiliary storage:
- see section 3.2.1.2

TABLE 2. K6 DATA COLLECTION

RS	DATA COLLECTED	ENTRY TO	MODE	OTHER CONDITIONS/CONSTRAINTS
DC01 1	MDR	DNLK	3	
DC01 2	Uplink RDR, GRAM, GRRM	DNLK	3	
DC01 3	TVM, RDR, RAM, RRM	DNLK	3	
DC02 4	PDR, RAM, RRM, TDR	CMUP	2	RTYPE - 4
DC02 5	PDR, RAM, RRM	CMUP	0,1,2	(a) CMUP queued by CMUP, or (b) NREG - -3
DC03 6	RDR, RAM1, RRM1	BIDR	1	
DC03 7	RDR, RAM1, RRM1	BIDR	0,2	(a) NREG - -2 or -3,
DC03 8	RDR, RAM1, RRM1	BIDR	2	FTYPE - V(ENVM)
DC04 9	RDR, RAM1,RRM1	ALPR (MALV)	1,2	FTYPE - V(TDLN), V(VAL)
DC04 10	RDR, RAM1, RRM1	ALPR (MALV)	0,1,2	(a) NREG - -2 or -3
DC05 11	RDR, RAM, RRM, TDR	NTRK	1,2	FTYPE - V(AAA), V(VAL), V(RACQ), V(TRUP)
DC05 12	RDR, RAM, RRM, TDR	NTRK	0,1	NREG - -2 or -3
DC05 13	RDR, RAM, RRM, TDR	NTRK	3	Target Hooked or ETP - 1, FTYPE - V(TRUP) OR V(RACQ)
DC06 14	RDR, RAM, RRM	SMRR	0	SMQ≠0
DC06 15	RDR, RAM, RRM	SMRR	0,1,2	Invalid RRM SMQ≠0
DC07 16	RDR, RAM, RRM	SMDR	0,1,2	SMDR queued by SMDM
DC08 17	SIMPTB	After SMIR & SMAB	0,1,2	
DC09 18	PARETB, SIMPTB, RDR, RIB	SMAB	All	X1≠0
DC10 19	AAACTL, FSSPP, FSSCDB, SCPTBL, SIMPTB*, RAPARS, RSF, PARETB, BYTMDS, MCILL, RMT	RARE	0,1,2	
DC10 19a	FRSMID	RARE	All	In Mode 3 EPCNT ≤ 1
DC11 20	SRAMTO, RDR	After BIDR	0,1,2	NREG > -1 FTYPE - V(ENVR), BRCHNG NQϕ
DC12 21	ENGAT, MDR EIMATB	CLIP	3	LTYPE - 1
DC13 22	LCSTAT, FSSPLG	After CLIP	All	In Mode 3 EPCNT ≤ 1
DC13 23	MML, CQT, DEST, MAF TDRADR, RCMQ	CATS	0	
DC14 24	MCI, RCD, AUDTBL	After SMCP	All	If number of words collected < 2250
DC15 25	CCIN, CCOUT	After CATS	All	
DC16 26	MDR, TDR	After PLCC	3	
	SRAMTO**, MCATR, MCILL, MCQUID, DIFS, MCBEAM, MCTVMD, ROUTTQ, RTYPCT, CMCLMF, TVMBIT, CMCLPT, CMFRES, CFC 1-4***, DRINDX	N/A		Premission Recording
	SRAMTO, CMCLMP, CMCLPT, CMRTES, CFC 1-4	N/A		Postmission Recording
DC17 27	ASCGFE	After DASP	All	EPCNT - ϕ
	RDR, RIB	After DASP	0,3	EPCNT - ϕ
DC18 28	MCILL	After GIDS	3	Once per flight after Missile Constrant set
DC19 29	TREPFF	ROAQ	All	
DC20 30	RDR, RIB	IFRP	0,1,2	
DC23 35	SDR	TRAP and STRP	2	Vin QUTASK

* Simple items - as in SIMPTB table in EDCPSI compool

* RMDIO, RMNST, and MUMTCT

*** ARRAYS

** STRAMT1 - SRAMT5

TABLE 3. BIDR INPUT BREAKDOWN

Inputs required by BIDR are listed, grouped according to the file or record in which they appear.

Search beam record: DC 11 SRAMTO - Available at data, (*Mode 0,1,2*) collection DC 11 *after* BIDR, *FTYPE = V(ENVR) NREG -1 BRCHNG NQ0*

- MOCK - monitor clock - can be changed in BIDR - (B **BIDR1B)
- BMDG - beam degraded indicator - can be changed in BIDR - (S***ROVLZD, B BIDR1B, CMUPZG)
- BEAMON - beam on-off indicator - can be changed in BIDR (S ROVLZD, U ****SRAPZC B, BIDR1B, CMUP2G)
- BNUM - beam number - not changed in BIDR (U ALPR2F, BIDR1B)
- CNUM - column number - not changed in BIDR (U ALPR2F, BIDR1B)
- RGS - receiver gain state - not changed in BIDR (U BIDR1B)
- BRRAM0 - first word of the BRRAM (word 0) - can be changed in BIDR (B BIDR1B)
- CSC - control sidelobe cancellation - can be changed in BIDR (B BIDR1B)
- *beam record* RAM copied into the RIB

CFAR Alarm Test Variables Table *(part of beam record)* DC 11

- CFC1 through CFC4 - beam-dependent CFAR comparison variables.
- ARRAY Constants - function of beam no. and column for RTYPE 4-7 from ENVGEN (S CMUP2G, U BIDR1B)

RDR:
- FTYPE - functional type of the radar action - RDR - Available at data collection DC03 *before* BIDR
- RTYPE - radar action type - DC3 *Mode 2, FTYPE = V(ENVM)*
- MCTIME - major cycle time of the radar action being processed
- NSCH - number of unsuccessful attempts to schedule the request
- RSCTR - sector identification
- RAM - address of the related beam record RAM
- various items copied into the output RDR

RAM (input RAM for the environment action): DC 3
- R1RAM0 - first word of the input RAM (word 0)
- RRAT1 - radar action time, fraction of a major cycle
- various items copied into the output RAM
- entire RAM copied for ALPR

} - RRMST Available at data collection DC03 before BIDR, Mode 2, FTYPE = V(ENVM)
} RIB

RRM:
- NRW1 - number of remaining words in the RRM DC 3
- NREG1 - contents of the N- register
- *CFAR11 through CFAR41* - CFAR *alarm indicators*
- SB11 through SB41
- SBML11 through SBML41
- GB11 through GB41
- GBML11 through GBML41
- COIN11 through COIN41

} interference indicators

} RAMSTD Available at data collection DC03 before BIDR, Mode 2, FTYPE = V(ENVM)

- PTRNG - point range of alarms (copied for ALPR)

SRPTBL (Search RTYPE Parameters Table):
- SBLNZ - search bottoming level for non-zero PFA - constant
- SSDCNZ - search SPG detection control for non-zero PFA (PFA = 10^{-6}) - constant
- RMINRC - *minimum instrumented range in range cells - constant* (U BIDR1B, CMUP2G)
- SBLZ - search bottoming level for zero PFA - constant
- SSDCZ - search SPG detection control for zero PFA - constant
- GBC - guard band blanking control - constant
- SLBOFS - sidelobe blanking offset in range cells - constant (constant part of SRP11)

RAP (Track RTYPE Parameters Table): RTYPCT
- RAP11 - SPG detection control for PFA = 10^{-3} - constant
- RAP18 - maximum instrumented range - constant

Surveillance State File: SCPTBL DC 10
- SCPEN - state control parameter-frequency diversity enabled (S DISH1H, U ALPR2F, BIDR1B, — — — — —)

IID Logic Constants Table:* CMC
- CMC1 through CMC7 - IID logic constants - constants (U BIDR1B)

CFAR Alarm test Constants Table:* CFC
- CFC1S through CFC4S - beam-independent CFAR comparison constants - constants (U BIDR1B)

Radar Load Table:* ARRAY DC 10
- RLT - *radar load counts - can be changed in BIDR* - (U DCRL0B, B BIDR1B)

Search RTYPE Inhibit Table:* ARRAY
- SRTINT - RTYPE-enabled indicators (complement of the DPSR form) - constant (U BIDR1B)

Beam Monitor Count Table:* ARRAY
- MOCKC - initial counts for the monitor clock - constant (U BIDR1B)

TABLE 3. (Continued)

BIDR Constants Table:* JTEM
BC1 through BC6 - constants used by BIDR - constant (U BIDR1B)

RIB auxiliary storage:
see section 3.2.1.2

DC* — DC value indicates data collection point
** — B indicates parameter both used and set in stated program
*** — S indicates parameter set in stated program
**** — U indicates parameter used in stated program.

sources and set/use definitions is shown in *Table 3*. From this table, it is observed that the Maximum MRT information was created only when FTYPE = V (ENVM), NREG >-1 and BRCHING NQ♦. For this case, Radar Data Record (RDR) and Radar Input Buffer (RIB) data is collected at entry to BIDR and the Search Beam Record (SRAMTO) data is collected upon exit of BIDR. Also, the Surveillance State File (SCPTBL) and the Radar Load Table (RLT) data is collected earlier upon exit from RARE.

The remaining input data needed by BIDR is constant and can be generated by a nominal build with ENVGEN. However, it should be noted that several parameters collected in SRAMTO upon exit from BIDR can be changed in BIDR itself. Thus, to use the SRAMTO data as input to BIDR, it must be data from the immediate previous pass through BIDR. In addition, two input variables from SRAMTO, the beam degraded indicator (BMDG) and the beam on-off indicator (BEAMON) can also be changed in ROVLQD prior to entry of BIDR. There is no data collected to show these parameters.

The impact of these specific missing inputs (BMDG and BEAMON) on utilization of a MRT modified ENVGEN data tape for WCC simulator tests was discussed with experts in the operation of the BIDR software. It was determined that while educated guesses for these missing values should produce useful test programs with the WCC simulator, it was not recommended unless the test was of the highest priority, since several combinations of inputs might have to be run.

B. Program Unit SAPB Evaluation Results

Initial evaluation of the SAPB unit and its initialization requirements indicated the necessary input data was available on applicable MRT's. A data extraction program utilizing the general purpose MRT driver previously developed for MSSC was developed for the 1108 computer. This program was then utilized to supply the required input to the SAPB single unit software test program recently made operational on the MSSC 1108 computer. This allows a thorough analysis of the SAPB software, under actual test conditions, through traces, snapshots, dumps, etc, to determine if the software is responding correctly.

(1) Program Discussion. The General Purpose MRT Driver program scans the input MRT until the MCI range of interest is located. The contents of the appropriate MRT table are searched for data of interest. For example, if SAPB was to be tested, the Missile Data Record (MDR) and the

Major Cycle Guidance Record (MCGUID) would be located. Once these tables/records are located the following data is removed.

From MDR Table:

- MCID - Major Cycle Interrupt (MCI)
- TGO - Time-to-go to intercept
- TM1 - Time to Major Cycle of Next U/L for Missile Away
- FMODE - Fuse Request Flag
- MDTDT - Engaged target number
- VM - Magnitude of Missile Velocity
- PUMPH - Predicted Missile H position
- PUMPX - Predicted Missile X position
- PUMPZ - Predicted Missile Z position

From MCGUID Table:

- HR - Radar Altitude above sea level
- TBSI - TGO after which auto pilot band is prohibited.

This data is used to generate a card deck or Fastran file which is used as input to the program to be tested (SAPB).

The data retrival program requires the user to determine which software unit is to be tested. A demonstration of the program was set up using the SAPB unit. SAPB requires data to be retrieved from an MDR and MCGUID table. The particular data required is listed in section (1) above.

The SAPB Test Procedures (MICG-2014-627 dated 6/5/75) were used to demonstrate the feasibility of single unit software testing. The SAPB software test source program was compiled and assembled into WCC assembly code. The data for SAPB was removed from the MRT and set up as Data Set 2. Data Set 1 is the ENVGEN data required to initialize SAPB.

The selection of different software elements for test will require the data retrieval program to be modified such that the required data will be collected.

(2) Input. The inputs required for the data retrieval program are as follows:

- Mission Recording Tape
- Major Cycle Range

(3) Output. The output from the data retrieval program are as follows:

- Listing of the retrieved data
- Punch Cards or Fastran File of the retrieved data

(4) Program Limitations. The required input data must be available on the MRT.

(5) MRT Data Retrieval Program for SAPB Flowchart. A flowchart of the MSSC 1108 computer program set up to strip specific data (i.e., SAPB input data) from a MRT is presented - Appendix A.

(6) MRT Data Retrieval Program for SAPB Program Listing. Appendix B contains the MSSC 1108 computer program listing for the data retrieval program.

(7) SAPB Test Deck Listing. A listing of the SAPB software test program recently made operational on the MSSC 1108 computer is presented in Appendix C.

(8) SAPB Software Test Program Output. The output from the test demonstration program using program unit SAPB is made up of the following items:

- List of variable not defined in compool (Data Set 1) and SAPB variables taken from MRT (Data Set 2).

- A detailed print out of the driver program (a set of WCC control cards) used to test SAPB. The driver is responsible for the following tasks:

— Sets up the environment for simulation (MEM, PROC and PRESET).

— Loads program unit to be tested.

— Sets up simulation core map (OCTAL x, y where x is compool block no. and y is address placed in BAT table at Location x in BAT table).

— Sets up linkage to System Service Procedures (OCTAL x, y where y is an address for the system service procedures to be placed in the BAT table at location x).

— Sets up linkage to all Math Package Procedures (set up same as d).

— Snap BAT TABLE.

— Loads all system ENVGEN and K7 MATH PACKAGE

— Set LOCAL STORAGE.

— Set all dedicated index registers (use panel command).

— Generates timing information.

— Snap MAP and NMAX.

— Load variables not set in compool.

— Load input variables required by SAPB.

— Turns count on for all processors.

— Executes test program.

• After WCC SIMULATION is started the following items are printed:

— PANEL, Index registers, and BAT Table.

— Driver program cards as they are executed.

— Snap of NMAX and MAP.

— Instruction count.

— Timing information.

— A typical output of the above items is shown in Appendix D.

4. CONCLUSIONS-RECOMMENDATIONS

Reformatting of existent MRT data into an ENVGEN data base for use as a test tool with the WCC simulator may or may not be feasible on a case-by-case basis. For example, the lack of certain necessary MRT data and inconsistencies in MRT data retrieval timing make BIDR unsuitable for MRT-aided ENVGEN data set testing. However, the technique is very acceptable for the simpler SAPB program unit, where no missing data or data retrieval timing problems existed for the applicable MRT's.

The wide variations in data collected on MRT's and the input requirements of the various threads/program units make it unfeasible to develop a computer program which automatically creates the ENVGEN data set.

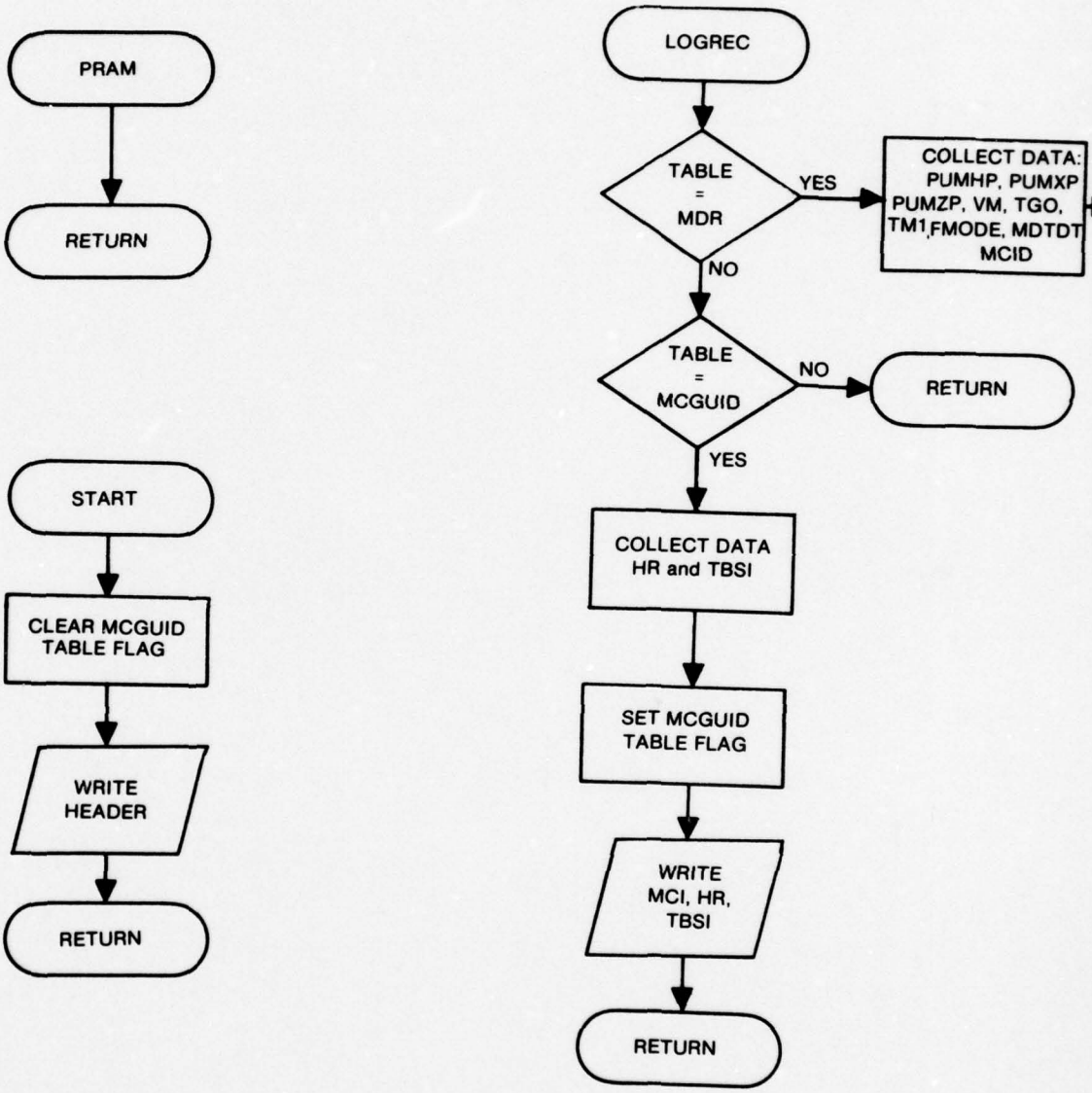
It is recommended that a case-by-case evaluation be made of any *thread/program unit chosen to be* tested with a MRT created ENVGEN data set. Following the techniques shown in the BIDR and SAPB program unit evaluations, one can:

• Determine if it is feasible to create a MRT based ENVGEN data set for the thread/program unit in question, and

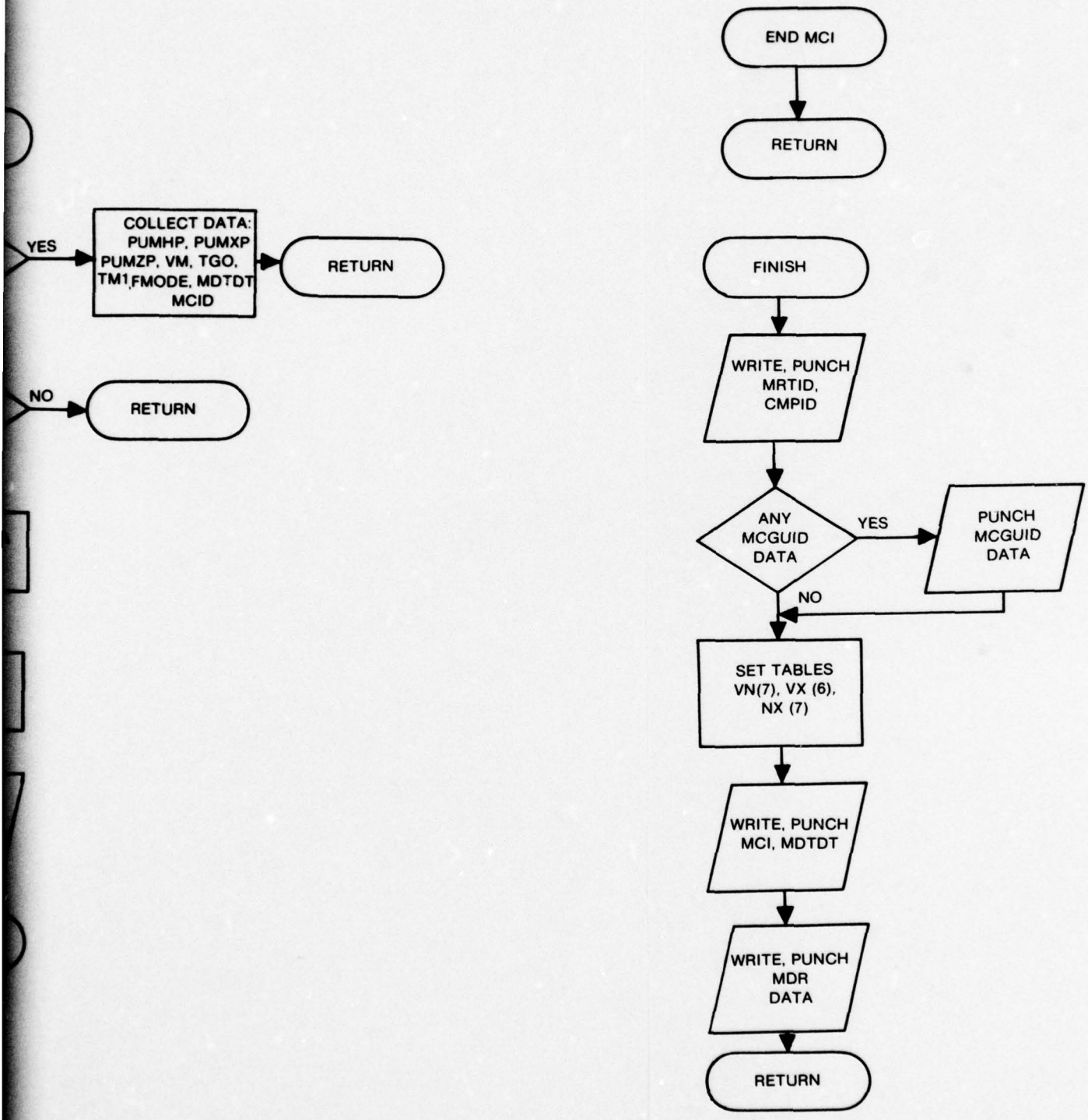
• If feasible, outline a computer program for the WCC simulator to construct and utilize the MRT based ENVGEN data set.

APPENDIX A

MRT DATA RETRIEVAL PROGRAM FLOWCHART



APPENDIX A - MRT DATA RETRIEVAL PROGRAM FLOWCHART


YES
COLLECT DATA: PUMHP, PUMXP PUMZP, VM, TGO, TM1,FMODE, MDTDT MCID
RETURN
NO
RETURN
END MCI
RETURN
FINISH
WRITE, PUNCH MRTID, CMPID
ANY MCGUID DATA
YES
PUNCH MCGUID DATA
NO
SET TABLES VN(7), VX (6), NX (7)
WRITE, PUNCH MCI, MDTDT
WRITE, PUNCH MDR DATA
RETURN

APPENDIX B

MRT DATA RETRIEVAL PROGRAM LISTING

```
*FOR,IS       MRT-DATA
C
C
C
      SUBROUTINE    DATA
C
C
      COMMON/FLAGS /  MCIFST, MCILST, RECFST, RECLST, IRUNID(27), STOP  MRT188
      COMMON/TABLES/  XXXXX, LRSIZE, TESTNO, ICPU, IENTRY, INST, IEXIT,
     *           YYYY,KT, NIXS(6)
      COMMON/XMCIX /  MCI, IRIGH, IRIGM, IRIGS, IRIGMS                  MRT184
      COMMON/IDMRT /  MRTID(2), NREEL, CMPID(2), TDATE, TTIME           MRT182
C
      REAL      WFLTS      " FLOATING POINT FUNCTION
      LOGICAL   LEQUAL     " LOGICAL        FUNCTION
C
C . . . . . .
      ENTRY  PRAM( KEY, KARD, CARD )
      DIMENSION  KARD(12), CARD(12)
C
      RETURN
C . . . . . .
      ENTRY  START
C
      LOGICAL  FMCGU
      FMCGU = .FALSE.
C
      WRITE(6,902)
  902 FORMAT('1DATA FOR SAPB'///)
C
      RETURN
C . . . . . .
      ENTRY  LOGREC( TABLE , NENT , B )
      DIMENSION  B(1)
C
      IF( LEQUAL( TABLE , 'MDR...' ,6 ) )  GO TO 600
      IF( LEQUAL( TABLE , 'MCGUID' ,6 ) )  GO TO 500
C
      RETURN
C . . . . . .
C               MCGUID
C
  500 CONTINUE
      HR   = WFLTS( B(628) )  " RADAR ALTITUDE ABOVE SEA LEVEL
      TBSI = WFLTS( B(105) )  " TGO AFTER WHICH AP BAND PROHIB.
C
      FMCGU = .TRUE.
      WRITE(6,910)  MCI, HR, TBSI
  910 FORMAT(/' MCI=',I6,5X,'HR=',F10.1,5X,'TBSI=',F10.1/)
      RETURN
C
C . . . . . .
C
C               MDR...
C
      DATA  MDR/0/, MDMIDC/94/, MDMSL/111/, MDSTAT/223/, MDR600/152/
C
      INTEGER  FMODE
C
```

MRT DATA RETRIEVAL PROGRAM LISTING (Continued)

```
  600 CONTINUE
      PUMMP = WFLTS( B(MDMSL+88) ) * PREDICTED MISSILE M-POSITION
      PUMXP = WFLTS( B(MDMSL+14) ) * PREDICTED MISSILE X-POSITION
      PUMZP = WFLTS( B(MDMSL+17) ) * PREDICTED MISSILE Z-POSITION
      VM    = WFLTS( B(MDMSL+39) ) * MAGNITUDE OF MISSILE VELOCITY
      TGO   = WFLTS( B(MDMIDC+7) ) * TIME-TO-GO-TO-INTERCEPT
      TM1   = WFLTS( B(MDSTAT+6) ) * TIME TO MC OF NEXT U/L MRT MSL AWAY
      FMODE = INTU( B(MDSTAT+8),  1, 3 ) * FUZE REQUEST FLAG
      MDTDT = INTS( B(MDR888+1), 24, 8 ) * ENGAGED TARGET NUMBER
      MCID  = MCI
C
      RETURN
C . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
C
      ENTRY  END MCI
C
      RETURN
C . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
C
      ENTRY  FINISH
C
      DIMENSION  VN(8), VX(8), NX(8)
      EQUIVALENCE      ( VX   , NX   )
C
      WRITE(6,903)  MRTID,  CMPID
      PUNCH   903,  MRTID,  CMPID
  903 FORMAT(3H ''/' $APB',3H ''/
     *  3H ''/' MRT ID = ',2A6,' COMPOOL ID = ',2A6,3H '')
      IF( FMCGU )  PUNCH 912,  HR, TBSI
  912 FORMAT(1X,'HR=',F12.1,'   $'/1X,'TBSI=',F10.1,'   $')
C
      VN(1) = 'PUMMP'
      VX(1) =  PUMMP
      VN(2) = 'PUMXP'
      VX(2) =  PUMXP
      VN(3) = 'PUMZP'
      VX(3) =  PUMZP
      VN(4) = 'VM'
      VX(4) =  VM
      VN(5) = 'TGO'
      VX(5) =  TGO
      VN(6) = 'TM1'
      VX(6) =  TM1
      VN(7) = 'FMODE'
      NX(7) =  FMODE
C
      WRITE(6,920)  MCID, MDTDT
      PUNCH   920,  MCID, MDTDT
  920 FORMAT(3H ''/' MCI='I6,5X,'MDTDT='I3,3H '')
C
      WRITE(6,922)  ( VN(J), VX(J), J=1,6 )
      PUNCH   922,  ( VN(J), VX(J), J=1,6 )
  922 FORMAT(1X,A6,'=',F10.1,'   $')
C
      WRITE(6,924)  ( VN(J), NX(J), J=7,7 )
      PUNCH   924,  ( VN(J), NX(J), J=7,7 )
  924 FORMAT(1X,A6,'=',I10,'   $')
C
      RETURN
      END
```

APPENDIX C

SAPB SOFTWARE TEST PROGRAM LISTING

SAPB SOFTWARE TEST PROGRAM LISTING

```
*ASG,CP  SAPB.
*USE     PGM.,SAPB.
*ASG,AX  ED=CC.
*ASG,A  K78C=COMPOOL.
*PRT,I
*ED=CC.JOV,IOL  SAPB.SOURCE,SAPB.ASM,,,K78C=COMPOOL.
        ASSEMB(PZ)   $
OPTIN            $                                                          000200
      START SAPB,0(61000) $
                                                                            000301
                                                                            000302
!!**********************************************************************!!000400
!!****                                                              ****!!000401
!!****                          SAPBBE                              ****!!000402
!!****                                                              ****!!000500
!!****            SAPB COMPUTES THE MISSILE AUTOPILOT BAND AND      ****!!000501
!!****        THE MAXIMUM ALLOWABLE MISSILE ACCELERATION.           ****!!000600
!!****                                                              ****!!000700
!!**********************************************************************!!000800
                                                                            001000
        ITEM PRG'VM   H  8 P 8H(ANYTHING)  $                                001100
        ITEM ALT    F              $ ''MISSILE ALTITUDE''                   001200
        ITEM AMB    F              $  ''BANDSW PARAMTR''                    001300
        ITEM AYI    F              $  ''SPEED OF SOUND AT ALT''             001400
        ITEM CB     F              $  ''AERODYN COEF''                      001500
        ITEM CB1    F              $                                        001600
        ITEM CB2    F              $                                        001700
        ITEM CN     F              $  ''NORMAL FORCE COEF''                 001800
        ITEM FMACH  F              $  ''WORKING VARIABLE''                  001900
        ITEM FRACH  F              $  ''WORKING VARIABLE''                  002000
        ITEM GMACH  F              $  ''MISSILE MACH''                      002100
        ITEM IMB    I 23 U         $                                        002200
        ITEM IYY    F              $  ''PITCH MOMENT''                      002300
        ITEM KP1    I 23 U         $                                        002400
        ITEM MM     F              $  ''MISSILE MASS''                      002500
        ITEM MR     F              $  ''WORKING VARIABLE''                  002600
        ITEM MR1    F              $                                        002700
        ITEM MR2    F              $                                        002800
        ITEM MR3    F              $                                        002900
        ITEM MR5    F              $                                        002901
        ITEM NP1    I 23 U         $                                        003000
        ITEM NSTAB  F              $  ''LATERAL ACCEL''                     003100
        ITEM QM     F              $  ''DYNAMIC PRESS''                     003200
        ITEM RHOI   F              $  ''ATMOSPHERIC DENSITY''               003300
        ITEM SK     I 23 U         $                                        003400
        ITEM SN     I 23 U         $                                        003500
        ITEM TALT   F              $  ''WORKING ALT VARIABLE''              003600
        ITEM TEMB1  F              $                                        003700
        ITEM TEMB2  F              $                                        003800
        ITEM TEMP   F              $  ''WORKING VARIABLE''                  003900
        ITEM TEMP1  F              $                                        004000
                                                                            004002
!!**********************************************************************!!004004
                                                                            004006
        OVERLAY  MM = MR1 = MR2 = MR3 = MR5 = TEMP = TEMP1 $                004008
        OVERLAY  ALT = TEMB1 = TEMB2 = AMB       $                          004009
        OVERLAY  GMACH = CB = MM       $                                    004008
                                                                            004010
!!**********************************************************************!!004012
```

SAPB SOFTWARE TEST PROGRAM LISTING (Continued)

```
                                                                        004014
!!      CORRECT FOR RADAR ALTITUDE ABOVE SEA LEVEL                    !!004400
                                                                        004402
        TALT=PUMXP*PUMXP+PUMZP*PUMZP    $                               004500
        ALT = PUMMP + MR + (TALT/(F2*REARTH))     $!!F2 = 2.0           !!004600
                                                                        004602
        IF TESTM NQ F0                  $!!IMPLEMENTED FOR PURPOSES     !!004604
           BEGIN                                                        004606
              ALT = ALT + MMODE*F4000   $!!OF TEST INTEGRATION          !!004608
           END                                                          004610
                                                                        004612
        IMB  =MENT(EMA)-1           $     !!FIND INDEX N!!              004700
        IF ALT GQ EMA($IMB$)        $                                   004800
         BEGIN                                                          004900
        SN  =IMB                    $                                   005000
        NP1 =IMB                    $                                   005100
        GOTO  SET1                  $                                   005200
         END                                                            005300
         FOR N = IMB-1,-1,0         $                                   005400
         BEGIN                                                          005500
         IF EMA(SNS)GR ALT          $                                   005600
         TEST                       $                                   005700
          SN=N                      $                                   005800
          NP1= N+1                  $                                   005900
        TEMP  =ALT-EMA(SNS)         $  !!INPLT FOR ALT RATIOLOOKUP!!    006000
        FRACM = TEMP/(EMA(SNP1S)-EMA(SNS))  $                           006100
        MR    = FRACM *(EAS(SNP1S)-EAS(SNS))$                           006200
        AYI =  EAS(SNS)+MR          $         !!CALC SPEED OF SOUND!!    006300
        MR1 = FRACM*(ERHO(SNP1S)-ERHO(SNS)) $  !!CALC DENSITY!!        006400
        RHOI =ERHO(SNS)+MR1         $                                   006500
        CN= ECN(SNS)+FRACM*(ECN(SNP1S)-                                 006600
            ECN(SNS))               $!!COMPUTE LIFT COEF!!              006700
        GOTO SET2                   $                                   006800
        END                                                             006900
        SN  = 0                     $                                   007000
        NP1 = 0                     $                                   007100
                                                                        007102
SET1.   AYI   =EAS(SSNS)            $                                   007200
        RHOI =ERHO(SSNS)            $                                   007300
        CN= ECN(SSNS)               $                                   007400
        FRACM = F0                        $                             007500
                                                                        007501
SET2.   GMACH = VM/AYI                    $                             007502
        MR5 = F0                          $                             007504
                                                                        007506
        IF TESTM NQ F0                    $                             007600
           BEGIN                                                        007602
              GMACH = GMACH + F4          $                             007604
              MR5 = GMACH*GMACH*AYI*AYI   $                             007700
           END                                                          007702
                                                                        007703
        QM = (F.5*RHOI)*(VM*VM + MR5)     $                             007704
        IF TGSI GO TGO ON FMODE           $                             007800
         GOTO  SET3                       $                             007900
        GOTO SET4                         $                             008000
                                                                        008002
SET3.   MAP  =MAPA                        $                             008100
         GOTO SET9                        $                             008200
                                                                        008202
SET4.   IF GMACH GQ EMACH(SIMBS)  $     !!CALC AP BAND!!                008300
```

SAPB SOFTWARE TEST PROGRAM LISTING (Continued)

```
          BEGIN
         SK  =IMB                    $
         KP1 =IMB                    $
           GOTO SET5                 $
          END
         FOR  K = IMB-1,-1,0         $
          BEGIN
         IF GMACH LS EMACH(SKS)      $
          TEST                       $
          SK =K                      $
          KP1=K+1                    $
         TEMP1=GMACH-EMACH(SKS)      $
         FRACH=TEMP1/(EMACH(SKP1S)-EMACH(SKS))      $
           GOTO SET6                 $
          END
         SK    =0                    $
         KP1   =0                    $

SET5.    FRACH = F0                       $

SET6.    TECB1  =ECB(SSN,SKS)             $
         MR2    =FRACH*(ECB(SNP1,SKS)-TECB1)    $
         CB1    =TECB1+MR2      $
         TECB2  =ECB(SSN,KP1S)        $
         MR3  =FRACH*(ECB(SNP1,KP1S)-TECB2)    $
         CB2 =TECB2+MR3     $
         CB    =FRACH*(CB2-CB1)+CB1 $
          IF TM1 LS TBO              $     ''BURNOUT NOT COMPLETE''
          BEGIN
          IYY = AIYY + BIYY*TM1      $
            GOTO SET7                $
          END
          IYY  = CIYY                $   ''AFTER BURNOUT''

SET7.    AMB  =GM*MAC*ARA*CB/IYY     $
         FOR  M = 0,1,10             $     ''FIND INDEX TOGET MAP''
          BEGIN
         IF AMB LS EMB(SMS)          $
           BEGIN
            IMB  = 11-M              $
           GOTO SET8                 $
            END
          END
         IMB     = 0                 $

SET8.    IF TM1 LQ TBO AND IMB GR IMBMAX   $
         IMB  = IMBMAX               $
         MAP  = EMAP(SIMBS)          $

SET9.    IF TM1 LS TBO               $
          BEGIN
          MM  =MBO+MDOT*(TBO-TM1)     $
          GOTO SETA                  $
          END
         MM   =MBC                   $

SETA.    NSTAB=GM*ARA*CN/MM          $
         IF NSTAB LS MSAL            $
          BEGIN
          NMAX = NSTAB               $
```

SAPB SOFTWARE TEST PROGRAM LISTING (Continued)

```
        GOTO SETB                    $                                  013980
        END                                                             014000
       NMAX  = MSAL                  $                                  014100
                                                                        014102
SETB.  RELEASE                       $                                  014200
       TERM                          $                                  014300
*ASG,A   EDMA=BIN.
*ASG,T   EOBJTT.,F
*USE          PGM.,EOBJTT.
*ASG,T        ESRCE.
*PRT,I
*ED=MCC.JOV,IEU    ESRCE.AA,EOBJTT.SAPE,,,K70C=COMPOOL.
    ASSEMB(F)  $
     START SAPE  $
    EMA($0$)=0.0,1000.0,2999.0,4999.0,7010.0,8992.0,10973.0,
             13990.0,16978.0,21001.0,23988.0,36576.0      $
     EAS($0$)= 340.3,336.4,328.6,320.6,312.3,303.9,295.3,
               295.1,295.1,295.1,295.1,317.5          $
     ERMU($0$)= 1.2250,1.1117,.9094,.7366,.5893,.4676,.3661,
               .2283,.1428,.0760,.0476,.0865      $
     EMACH($0$)= 0.0,0.5,1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,
               5.0,6.0          $
     ECN($0$)= 5.0,5.0,5.0,7.65,7.65,7.50,7.25,7.0,
               6.75,6.5,6.25,5.85          $
     EMAP($0$)= 1,2,3,4,5,6,7,8,9,10,11,12        $
     ECB($0,0$)= 57.9,57.9,57.9,57.9,57.9,57.9,57.9,57.9,
               57.9,57.9,57.9,57.9,57.9          $
     ECB($0,1$)= 57.9,57.9,57.9,57.9,57.9,57.9,63,57.9,
               57.9,57.9,57.9,57.9              $
     ECB($0,2$)= 45.8,45.8,45.8,45.8,45.8,45.8,49.9,45.8,
               45.8,45.8,45.8,45.8,45.8              $
     ECB($0,3$)= 37.2,35.5,35.5,34.9,34.9,34.9,37.8,34.9,
               34.9,34.9,34.9,34.9,34.9          $
     ECB($0,4$)= 27.5,26.4,27.5,27.5,28.6,28.1,29.8,29.2,
               30.4,29.8,28.1,28.1          $
     ECB($0,5$)=  22.9,23.5,23.5,23.5,25.2,26.9,27.5,26.9,
               26.4,27.5,24.1,26.4          $
     ECB($0,6$)= 19.5,19.5,20.0,21.2,21.2,22.9,26.9,25.8,
               26.4,26.4,26.4,26.4                $
     ECB($0,7$)= 16.0,16.0,16.8,17.2,19.5,20.6,24.1,25.8,
               26.9,26.4,26.4,24.1              $
     ECB($0,8$)= 13.8,13.8,14.3,14.9,16.0,17.7,22.3,22.9,
               27.5,26.4,26.9,25.8          $
     ECB($0,9$)= 13.8,14.3,14.3,14.3,15.5,17.2,21.8,21.8,
               26.9,26.9,27.5,28.1          $
     ECB($0,10$)= 14.3,14.9,14.9,15.5,15.5,16.6,19.5,21.2,
               25.2,28.1,26.9,33.2            $
     ECB($0,11$)= 14.3,14.9,15.5,15.5,16.0,16.6,18.9,20.6,
               25.2,29.8,29.8,29.8            $
     EMB($0$)= 25.4,41.0,65.0,90.0,123.0,123.0,168.0,230.0,
               314.0,430.0,775.0          $
     MAPA= 4       $
     REARTH=  6378000.0     $
     TBO=  11.4  $
     AIYY=  1540.2       $
     BIYY= -5.148        $
     CIYY=  940.5        $
     ARA=  0.1297      $
     MAC=  0.4054       $
     MOOT=  4.3592     $
```

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SAPB SOFTWARE TEST PROGRAM LISTING (Continued)

```
     HSALE=  294.4      $
     HBUE=  394.0     $
     IMBMAX= 11           $
     PUMMP= 9103.0      $
     PUMXP=  100040.0       $
     PUMZP=  24382.0       $
     HR= 1000.0      $
     VM=  1700.0     $
     THSI= 1.0     $
     FMODE=  0     $
     TGO=  100.0       $
     TMI=  9.0    $
ENDSET' 1  $
  '' SAPB ''
  '' HRT ID = HISTRY          COMPOOL ID = U0580NK01F78 ''
  HR=       1234.0     $
  TOSI=          .0    $
  '' MCI=  1000      MUTUT=  1 ''
  PUMMP =      3352.9    $
  PUMXP =    14770.0    $
  PUMZP =    10858.0    $
  VM    =     1157.4    $
  TGO   =        5.8    $
  TMI   =       27.0    $
  FMODE =          0    $
ENDSET' 2  $
       TERM  $
@PRT,I
@ASG,A EUNA@DRIVER.
@ELT      EUNA@DRIVER.ORG,EUNA@DRIVER.SIM
-137,139
-153,183
@PRT,S     EUNA@DRIVER.SIM
@USE PROG.,SAPB.
@USE    EOBJ.,EOBJIT.
@CALL,UM  EUNA@DRIVER.SIM,DUMY,SAPB
@PRT,I
@FIN
@@
```

APPENDIX D

SAPB SOFTWARE TEST PROGRAM OUTPUT

SAPB SOFTWARE TEST PROGRAM OUTPUT

```
       JOVIAL SAM-D COMPILER, VERSION 014 10 JAN 76    COMPILED       25 APR 78  AT    15.22.25                PAGE    1
000001                              ASSEMB(F)  $
000002                              START SAPE  $

THE FOLLOWING VARIABLES WERE NOT DEFINED IN THE COMPOOL

     NONE

000003          000001      EMA($0$)=0.0,1000.0,2999.0,4999.0,7010.0,8992.0,10973.0,                          SET    1
000004          000001                13990.0,16976.0,21001.0,23988.0,36576.0        $                        SET    1
000005          000002      EAS($0$)= 340.3,336.4,328.6,320.6,312.3,303.9,295.3,                              SET    1
000006          000002                295.1,295.1,295.1,295.1,317.5        $                                  SET    1
000007          000003      ERHO($0$)= 1.2250,1.1117,.9094,.7364,.5893,.4676,.3661,                           SET    1
000008          000003                .2283,.1428,.0760,.0470,.0005      $                                    SET    1
000009          000004      EMACH($0$)= 0.0,0.5,1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,                              SET    1
000010          000004                5.0,6.0          $                                                      SET    1
000011          000005      ECN($0$)= 5.0,5.0,5.0,7.05,7.65,7.50,7.25,7.0,                                    SET    1
000012          000005                6.75,6.5,6.25,5.65        $                                             SET    1
000013          000006      EMAP($0$)= 1,2,3,4,5,6,7,8,9,10,11,12          $                                  SET    1
000014          000007      ECD($0,0$)= 57.9,57.9,57.9,57.9,57.9,57.9,57.9,57.9,                              SET    1
000015          000007                57.9,57.9,57.9,57.9          $                                          SET    1
000016          000008      ECD($0,1$)= 57.9,57.9,57.9,57.9,57.9,57.9,63,57.9,                                SET    1
000017          000008                57.9,57.9,57.9,57.9          $                                          SET    1
000018          000009      ECD($0,2$)= 45.8,45.8,45.8,45.8,45.8,45.8,49.9,45.8,                              SET    1
000019          000009                45.8,45.8,45.8,45.8          $                                          SET    1
000020          000010      ECD($0,3$)= 37.2,35.5,35.5,34.9,34.9,34.9,37.8,34.9,                              SET    1
000021          000010                34.9,34.9,34.9,34.9          $                                          SET    1
000022          000011      ECD($0,4$)= 27.5,20.4,27.5,27.5,28.0,28.1,29.8,29.2,                              SET    1
000023          000011                30.4,29.8,28.1,28.1          $                                          SET    1
000024          000012      ECD($0,5$)=  22.9,23.5,23.5,23.5,25.2,26.9,27.5,26.9,                             SET    1
000025          000012                26.4,27.5,29.1,26.4          $                                          SET    1
000026          000013      ECD($0,6$)= 19.5,19.5,20.0,21.2,21.2,22.9,26.9,25.8,                              SET    1
000027          000013                26.4,26.4,26.4,26.4            $                                        SET    1
000028          000014      ECD($0,7$)= 16.0,16.0,16.6,17.2,19.5,20.6,24.1,25.8,                              SET    1
000029          000014                26.9,26.4,26.4,24.1          $                                          SET    1
000030          000015      ECD($0,8$)= 13.8,13.8,14.3,14.9,16.0,17.7,22.3,22.9,                              SET    1
000031          000015                27.5,26.4,26.9,25.8        $                                            SET    1
000032          000016      ECD($0,9$)= 13.8,14.3,14.3,14.3,15.5,17.2,21.8,21.8,                              SET    1
000033          000016                26.9,26.9,27.5,28.1          $                                          SET    1
000034          000017      ECD($0,10$)= 14.3,14.9,14.9,15.5,15.5,16.6,19.5,21.2,                             SET    1
000035          000017                25.2,28.1,26.9,33.2          $                                          SET    1
000036          000018      ECD($0,11$)= 14.3,14.9,15.5,15.5,16.0,16.6,18.9,20.6,                             SET    1
000037          000018                25.2,29.8,29.8,29.8          $                                          SET    1
000038          000019      EMB($0$)= 25.4,41.0,65.0,90.0,123.0,123.0,168.0,230.0,                            SET    1
000039          000019                314.0,430.0,775.0       $                                               SET    1
000040          000020      MAPA= 4      $                                                                    SET    1
000041          000021      REARTH= 6378000.0     $                                                           SET    1
000042          000022      TUU= 11.4  $                                                                      SET    1
000043          000023      AITT= 1540.2      $                                                               SET    1
000044          000024      BITT= -5.148      $                                                               SET    1
000045          000025      CITT= 940.5     $                                                                 SET    1
000046          000026      AMA= 0.1297     $                                                                 SET    1
000047          000027      MAC= 0.4054      $                                                                SET    1
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
EW V04                                                                PAGE  2

000048    000028        MOUT=  4.3592    $                            SET   1
000049    000029        MSAL=  298.4     $                            SET   1
000050    000030        MBO=  394.0    $                              SET   1
000051    000031        INGMAX= 11       $                            SET   1
000052    000032        PUMHP= 9163.0    $                            SET   1
000053    000033        PUMXP=  100000.0   $                          SET   1
000054    000034        PUMZP=  24382.0    $                          SET   1
000055    000035        HR= 1000.0    $                               SET   1
000056    000036        VM=  1700.0    $                              SET   1
000057    000037        THSI= 1.0    $                                SET   1
000058    000038        FMODE=  0   $                                 SET   1
000059    000039        IGU=  100.0      $                            SET   1
000060    000040        TM1=  9.0    $                                SET   1
000061    000041     ENDSET: 1  $                                     SET   1
000062    000042      '' SAPU ''                                      SET   2
000063    000042      '' MRT ID = MISS29        COMPOOL ID = U6506NK61578 ''   SET   2
000064    000042     HR=         1234.0    $                          SET   2
000065    000043     THSI=           .3    $                          SET   2
000066    000044     '' MCI=  1000     MOTDT=  1 ''                   SET   2
000067    000044     PUMHP =     3352.9    $                          SET   2
000068    000045     PUMXP =   12776.0     $                          SET   2
000069    000046     PUMZP =   16650.0     $                          SET   2
000070    000047     VM    =     1157.4    $                          SET   2
000071    000048     IGU   =        5.4    $                          SET   2
000072    000049     TM1   =       20.6    $                          SET   2
000073    000050     FMODE =          0    $                          SET   2
000074    000051     ENDSET: 2  $                                     SET   2
000075    000052          TERM $
 TERMINATION TIME     15:25:04

BAUD,P TEMPLU.

GRUPDCC.ASM,F                ASMSOURCE.SAPE
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
EDWA*DRIVER(1).SIM(0)
      @ASG,A EDWA*BIN.
      @USE PGM.,EDWA*BIN.
      @ASG,A EDASIM*CC2.
      @ADD EDASIM*CC2.
      REMARK.*************************************************************************
      MEM 0,1,2                      .  USE MEMORIES 0,1,2
      PROC 1,,0,02000,02155          .  HAT AT ZERO,CPU1,1ST LEVEL LOCAL STOR
      PRESET 040000000               .  FILL MEMORY WITH TRD TO LOC ZERO
      ASSIGN PGM=PROG                .  ASSIGN PROGRAM BINARY FILE
      LOADF 62,061000                .  LOAD PROGRAM UNDER TEST
      REMARK.*************************************************************************
      REMARK.*****                  SET SIMULATION CORE MAP                        *****
      REMARK.*************************************************************************
      OCTAL  1,03000                 .  COMPOOL BLOCK 1
      OCTAL  2,04000                 .  COMPOOL BLOCK 2
      OCTAL  3,05300                 .  COMPOOL BLOCK 3
      OCTAL  6,05000                 .  COMPOOL BLOCK 6
      OCTAL 12,06500                 .  COMPOOL BLOCK 12
      OCTAL 13,06600                 .  COMPOOL BLOCK 13
      OCTAL 14,07200                 .  COMPOOL BLOCK 14
      OCTAL 71,022700                .  COMPOOL BLOCK 71
      OCTAL 73,034700                .  COMPOOL BLOCK 73
      OCTAL 77,035100                .  COMPOOL BLOCK 77
      OCTAL 133,050700               .  COMPOOL BLOCK 133
      OCTAL 135,051500               .  COMPOOL BLOCK 135
      OCTAL 168,052200               .  COMPOOL BLOCK 168
      OCTAL 173,052400               .  COMPOOL BLOCK 173
      REMARK.*************************************************************************
      REMARK.*****          LINK USER WITH ALL SYSTEM SERVICE PROCEDURES           *****
      REMARK.*************************************************************************
      OCTAL  26,040130023            .   LINK TO GD05
      OCTAL  66,040130023            .   LINK TO ERCK
      OCTAL  67,040130023            .   LINK TO MTML
      OCTAL  68,040130023            .   LINK TO GD01
      OCTAL  69,040130023            .   LINK TO CONTGO
      OCTAL  70,040130023            .   LINK TO GD02
      OCTAL  72,040130023            .   LINK TO GD03
      OCTAL  76,040130023            .   LINK TO CUGC
      OCTAL  79,040130023            .   LINK TO COPY
      OCTAL  82,040130023            .   LINK TO CURL
      OCTAL  85,040130023            .   LINK TO LASA
      OCTAL  90,040130023            .   LINK TO GD04
      OCTAL  92,040130023            .   LINK TO EHSI
      OCTAL  93,040130023            .   LINK TO ECEL
      OCTAL  94,040130023            .   LINK TO EOLN
      OCTAL  95,040130023            .   LINK TO ELGU
      OCTAL  96,040130023            .   LINK TO ETPU
      OCTAL 100,040130023            .   LINK TO LFIL
      OCTAL 111,040130023            .   LINK TO ELMP
      OCTAL 112,040130023            .   LINK TO ETMC
      OCTAL 113,040130023            .   LINK TO ETED
      OCTAL 114,040130023            .   LINK TO EVLC
      OCTAL 115,040130023            .   LINK TO THOD
      OCTAL 116,040130023            .   LINK TO TBUA
      OCTAL 117,040130023            .   LINK TO TBUR
      OCTAL 119,040130023            .   LINK TO TBUU
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
 57     OCTAL 120,040136023          .   LINK TO TBOS
 58     OCTAL 123,040136023          .   LINK TO ULKTMO
 59     OCTAL 128,040136023          .   LINK TO DTGT
 60     OCTAL 129,040136023          .   LINK TO TBOK
 61     OCTAL 130,040136023          .   LINK TO EFES
 62     OCTAL 131,040136023          .   LINK TO FIED
 63     OCTAL 176,040136023          .   LINK TO ETFL
 64     OCTAL 174,040136023          .   LINK TO FETM
 65     OCTAL 101,040136023          .   LINK TO IFGR
 66     OCTAL 102,040136023          .   LINK TO ASIFIB
 67     OCTAL 103,040136023          .   LINK TO IFFR
 68     OCTAL 191,040136023          .   LINK TO USIFIB
 69     OCTAL 195,040136023          .   LINK TO DSNTUR
 70     OCTAL 196,040136023          .   LINK TO ASUMUR
 71     OCTAL 197,040136023          .   LINK TO USUMUR
 72     OCTAL 198,040136023          .   LINK TO LOKFUM
 73     OCTAL 199,040136023          .   LINK TO ULKEUM
 74     OCTAL 200,040136023          .   LINK TO ASKIM
 75     OCTAL 201,040136023          .   LINK TO USKIB
 76     OCTAL 202,040136023          .   LINK TO ASVRIB
 77     OCTAL 203,040136023          .   LINK TO USVRIB
 78     OCTAL 204,040136023          .   LINK TO MUTASK
 79     OCTAL 206,040136023          .   LINK TO MUCMSG
 80     OCTAL 210,040136023          .   LINK TO TYPE
 81     OCTAL 214,040136023          .   LINK TO ASNSUR
 82     OCTAL 215,040136023          .   LINK TO USNSUR
 83     OCTAL 220,040136023          .   LINK TO LINKID
 84     OCTAL 230,040136023          .   LINK TO LINKMD
 85     OCTAL 237,040136023          .   LINK TO ASTRUR
 86     OCTAL 238,040136023          .   LINK TO USTRUR
 87     OCTAL 239,040136023          .   LINK TO ASTRIB
 88     OCTAL 240,040136023          .   LINK TO USTRIB
 89     OCTAL 243,040136023          .   LINK TO AUDIT3
 90     OCTAL 245,040136023          .   LINK TO ASGRAB
 91     OCTAL 246,040136023          .   LINK TO USGRIB
 92     OCTAL 247,040136023          .   LINK TO LOKTUR
 93     OCTAL 248,040136023          .   LINK TO ULKTUR
 94     OCTAL 251,040136023          .   LINK TO MUALRT
 95     OCTAL 255,040136000          .   LINK TO RELESE
 96     REMARK.*************************************************************
 97     REMARK.*****      LINK USER WITH ALL MATH PACKAGE PROCEDURES      *****
 98     REMARK.*************************************************************
 99     OCTAL 103,040002300          .   LINK TO ACOS
100     OCTAL 104,040002301          .   LINK TO ASIN
101     OCTAL 105,040002302          .   LINK TO ATAN
102     OCTAL 106,040002303          .   LINK TO COS
103     OCTAL 107,040002304          .   LINK TO SIN
104     OCTAL 108,040002305          .   LINK TO TAN
105     OCTAL 109,040002306          .   LINK TO LOG
106     OCTAL 110,040002307          .   LINK TO EXP
107     PAUSE 1,013777B              .   PAUSE TO SNAP BAT TABLE
108     SNAP 1,013777B,0,0777,0,P    .   SNAP BAT TABLE
109     GOTO 1,013777B               .   EXECUTE SNAP FOR SORP
110     SNAPD 1,013777B,0,0777       .   DEACTIVATE SNAP
111     REMARK.*************************************************************
112     REMARK.*****      LOAD ALL SYSTEM ENVOLN AND K7 MATH PACKAGE      *****
113     REMARK.*************************************************************
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
 114      ASSIGN PROG=PGM                .   ASSIGN SYSTEM BINARY FILE
 115      LOADF TRIG2=.02300             .   LOAD K7 MATH PACKAGE
 116      LOADF A7ENV1.1                 .   LOAD K7 SYSTEM ENVGEN
 117      REMARK.*****************************************************************
 118      REMARK.*****                SET LOCAL STORAGE LEVELS                *****
 119      REMARK.*****************************************************************
 120      OCTAL 0.000,0.1560             .   LOCAL STORAGE LEVEL 1
 121      OCTAL 0.1560,0.2330,02000      .   LOCAL STORAGE LEVEL 2
 122      OCTAL 0.2330,0.2330,0.2560     .   LOCAL STORAGE LEVEL 3
 123      REMARK.*****************************************************************
 124      REMARK.*****           SET ALL DEDICATED INDEX REGISTERS            *****
 125      REMARK.*****************************************************************
 126      PANEL 1,X0=02000,X1=03000,X2=04000,X3=05300,X6=05600,X7=06500.
 127      PANEL 1,15=06600,14=07200,15=0,MP=01000.
 128      STOP 1,0                       .   STOP AT ZERO TO CATCH RUNAWAY PROGRAM
 129      REMARK.*****  NOTE THAT ALL EXTERNAL DUMMY SYSTEM PROCEDURES          *****
 130      REMARK.*****  START AT LOCATION 0136023.LOCATION 0136024 CONTAINS     *****
 131      REMARK.*****  AN MP INSTRUCTION. PROCEDURE RELEASE STARTS AT 0136000  *****
 132      REMARK.*****  TO ALLOW THE USER TO PLACE SNAPS,TRACES,ETC ON THE      *****
 133      REMARK.*****  MVP INSTRUCTIONS FROM 0136000 TO 0136023.
 134      OCTAL 0136000,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,043000000.
 135      REMARK.*****************************************************************
 136       OCTAL 015015,0.
 137         PAUSE 1,0136005
 138         TIME   1,061000,061456,0
 139         SNAP   1,0136000,0405A,0405A,0
 140         SNAP   1,0136005,04267,04267,S
 141         GUIN 1,0136004
 142       ASSIGN  PGM=EUBJ
 143       LOADF   SAPB,1
 144         COUNT    0,ON
 145         GUIN     1,0x1000
 146         COUNT    OUT
 147       LOADF   SAPB,2
 148         COUNT    0,ON
 149         GUIN     1,061000
 150      STOP 1,0136023
 151      GOTO 1,0136023


@USE PROG,,SAPB.


@USE    EUBJ,,EUBJTT.


@CALL,UM  EUBA*UNIVER,SIM,DUMY,SAPB
 4/25/78 15:29:31
 CALL 2,17

 OUTPUT FILE IS TEMP: $*RUELL*CALL$OUT
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
@ASG,A EDWA*BIN.
FAC WARNING       100000000000

@USE PGM.,EDWA*BIN.

@ASG,A EDWSIM*CCZ.
FAC WARNING       040000000200

@ADT EDWSIM*CCZ.
 V02N04 Z1376
REMARK.*****************************************************************
MEM 0:1:2                    . USE MEMORIES 0:1:2 .
PROC 1,,0,0Z000,0Z155        . BAT AT ZERO,CPU1,1ST LEVEL LOCAL STOR .
PRESET 040000000             . FILL MEMORY WITH TWD TO LOC ZERO .
ASSIGN PGM=PR0W              . ASSIGN PROGRAM BINARY FILE .
LOADF SAPW,001W00              . LOAD PROGRAM UNDER TEST .
REMARK.*****************************************************************
REMARK.*****          SET SIMULATION CORE MAP                    *****
REMARK.*****************************************************************
OCTAL  1,03000               . COMPOOL BLOCK 1 .
OCTAL  2,04000               . COMPOOL BLOCK 2 .
OCTAL  3,05300               . COMPOOL BLOCK 3 .
OCTAL  6,05000               . COMPOOL BLOCK 6 .
OCTAL 12,06500               . COMPOOL BLOCK 12.
OCTAL 13,00000               . COMPOOL BLOCK 13.
OCTAL 14,07200               . COMPOOL BLOCK 14.
OCTAL 71,022700              . COMPOOL BLOCK 71.
OCTAL 73,034700              . COMPOOL BLOCK 73.
OCTAL 77,035100              . COMPOOL BLOCK 77.
OCTAL 133,050700             . COMPOOL BLOCK 133
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
OCTAL 135,051500          . COMPOOL BLOCK 135    .
OCTAL 168,052200          . COMPOOL BLOCK 168    .
OCTAL 173,052400          . COMPOOL BLOCK 173    .
REMARK.*************************************************************
REMARK.*****      LINK USER WITH ALL SYSTEM SERVICE PROCEDURES      *****
REMARK.*************************************************************
OCTAL  20,0401360023      . LINK TO GDOS .
OCTAL  66,0401360023      . LINK TO ERCK .
OCTAL  67,0401360023      . LINK TO MTML .
OCTAL  68,0401360023      . LINK TO GD01 .
OCTAL  69,0401360023      . LINK TO LOKTBO .
OCTAL  70,0401360023      . LINK TO GD02 .
OCTAL  72,0401360023      . LINK TO GD03 .
OCTAL  76,0401360023      . LINK TO CUGC .
OCTAL  79,0401360023      . LINK TO CUPY .
OCTAL  82,0401360023      . LINK TO CUHL .
OCTAL  85,0401360023      . LINK TO LASA .
OCTAL  90,0401360023      . LINK TO GD04 .
OCTAL  92,0401360023      . LINK TO EMSI .
OCTAL  93,0401360023      . LINK TO ECEL .
OCTAL  94,0401360023      . LINK TO EDCN .
OCTAL  95,0401360023      . LINK TO ELGU .
OCTAL  96,0401360023      . LINK TO ETPU .
OCTAL 100,0401360023      . LINK TO LFIL .
OCTAL 111,0401360023      . LINK TO ELNP .
OCTAL 112,0401360023      . LINK TO ETMC .
OCTAL 113,0401360023      . LINK TO EIED .
OCTAL 114,0401360023      . LINK TO EVLC .
OCTAL 115,0401360023      . LINK TO TBGD .
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
OCTAL 116.0401360023  .  LINK TO TBUA  .
OCTAL 117.0401360023  .  LINK TO TBGR  .
OCTAL 119.0401360023  .  LINK TO TBGU  .
OCTAL 120.0401360023  .  LINK TO TBUG  .
OCTAL 125.0401360023  .  LINK TO ULKTBG .
OCTAL 128.0401360023  .  LINK TO UTGT  .
OCTAL 129.0401360023  .  LINK TO TBGK  .
OCTAL 130.0401360023  .  LINK TO EFES  .
OCTAL 131.0401360023  .  LINK TO EIED  .
OCTAL 176.0401360023  .  LINK TO ETFL  .
OCTAL 179.0401360023  .  LINK TO EFTM  .
OCTAL 181.0401360023  .  LINK TO IFWR  .
OCTAL 182.0401360023  .  LINK TO ASIFIB .
OCTAL 183.0401360023  .  LINK TO IFFR  .
OCTAL 191.0401360023  .  LINK TO USIFIB .
OCTAL 195.0401360023  .  LINK TO USNTUM .
OCTAL 196.0401360023  .  LINK TO ASNMUM .
OCTAL 197.0401360023  .  LINK TO USNMUM .
OCTAL 198.0401360023  .  LINK TO LOKEUB .
OCTAL 199.0401360023  .  LINK TO ULKEUB .
OCTAL 200.0401360023  .  LINK TO ASMIB  .
OCTAL 201.0401360023  .  LINK TO USMIB  .
OCTAL 202.0401360023  .  LINK TO ASVRIB .
OCTAL 203.0401360023  .  LINK TO USVRIB .
OCTAL 206.0401360023  .  LINK TO GUIASK .
OCTAL 208.0401360023  .  LINK TO GUCMSG .
OCTAL 210.0401360023  .  LINK TO TYPE  .
OCTAL 214.0401360023  .  LINK TO ASNSGM .
OCTAL 215.0401360023  .  LINK TO USNSUM .
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
OCTAL 220,040136023          . LINK TO LINKTD .
OCTAL 230,040136023          . LINK TO LINKMD .
OCTAL 237,040136023          . LINK TO ASTRDR .
OCTAL 238,040136023          . LINK TO DSTRDR .
OCTAL 239,040136023          . LINK TO ASTRIB .
OCTAL 240,040136023          . LINK TO DSTRIB .
OCTAL 243,040136023          . LINK TO AUDITJ .
OCTAL 245,040136023          . LINK TO ASGRIB .
OCTAL 246,040136023          . LINK TO DSGRIB .
OCTAL 247,040136023          . LINK TO LOKTDR .
OCTAL 248,040136023          . LINK TO ULKTDR .
OCTAL 251,040136023          . LINK TO GUALRT .
OCTAL 255,040136000          . LINK TO RELESE .
REMARK.*********************************************************************
REMARK.*****      LINK USER WITH ALL MATH PACKAGE PROCEDURES            *****
REMARK.*********************************************************************
OCTAL 103,040002300          . LINK TO ACOS   .
OCTAL 104,040002301          . LINK TO ASIN   .
OCTAL 105,040002302          . LINK TO ATAN   .
OCTAL 106,040002303          . LINK TO COS    .
OCTAL 107,040002304          . LINK TO SIN    .
OCTAL 108,040002305          . LINK TO TAN    .
OCTAL 109,040002306          . LINK TO LOG    .
OCTAL 110,040002307          . LINK TO EXP    .
PAUSE 1,013777o              . PAUSE TO SNAP BAT TABLE .
SNAP 1,013777o,0,0777,0,P    . SNAP BAT TABLE .
GOTO 1,013777o               . EXECUTE SNAP FOR SURP.
```

```
*CL MEMORY MAP
**************
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
PROGRAM ORIGIN   END     EXECUTE

SAPB    061000-061460    061000

BAT TABLE: 000000-000377

CPU1  LOCAL STORAGE : 002000 - 002155
CPU2  LOCAL STORAGE : 000000 - 000000
CPU3  LOCAL STORAGE : 000000 - 000000
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
START WCC SIMULATION

SNAP  REQUEST    PROGRAM ----    FROM 000000 TO 000777 AT LOCATION 137776    PROCESSOR CPU1
   PANEL FOR CPU1        AM:A1      OVERFLOW:OFF      COMPARE:      PROCESSOR ADDRESS:  01      OP ERR:OFF
      PR:00000000  SR:12000000  A1:00000000  Q1:00000000  A2:00000000  Q2:00000000
      MQ:00000000  R1:00000000  R2:00000000  R3:00000000  R4:00000000  R5:00000000  R6:00000000  BP:00000000
      TA:00000000  NC:00000000  SP:00000000  PP:00000000  L0:00000000  L1:00000000  L2:00000000  L3:00000000
      XB:00000000  X1:00000000  X2:00000000  X3:00000000  X4:00000000  X5:00000000  X6:00000000  X7:00000000
      XC:00000000  XY:00000000  10:00000000  11:00000000  12:00000000  13:00000000  14:00000000  15:00000000
000000  40000000  00003000  00004000  00003300  40000000  40000000  00005600  40000000  40000000  40000000  40000000  40000000
000014  00006000  00006000  00007200  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000030  40000000  40000000  40136023  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000044  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000060  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000074  40000000  40000000  40000000  40000000  40000000  40000000  40136023  40136023  40136023  40136023  40136023  00022700
000114  40136023  00034700  40000000  40000000  40136023  00035100  40000000  40136023  40000000  40000000  40136023  40000000
000124  40000000  40136023  40000000  40000000  40000000  40000000  40136023  40000000  40136023  40136023  40136023  40136023
000140  40136023  40000000  40000000  40000000  40136023  40000000  40000000  40002300  40002301  40002302  40002303  40002304
000154  40002305  40002306  40002307  40136023  40136023  40136023  40136023  40136023  40136023  40136023  40000000  40136023
000170  40136023  40000000  40000000  40136023  40000000  40000000  40000000  40000000  40136023  40136023  40136023  40000000
000204  40000000  00050700  40000000  00051500  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000220  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000234  40000000  40000000  40000000  40000000  40000000  40136023  40000000  40000000  40000000  40000000  40000000  40000000
000250  00052600  40000000  40000000  40000000  00052400  40000000  40000000  40000000  40136023  40000000  40000000  40136023
000264  40000000  40136023  40136023  40136023  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40136023
000300  40000000  40000000  40000000  40136023  40136023  40136023  40136023  40136023  40136023  40136023  40136023  40136023
000314  40000000  40000000  40136023  40000000  40136023  40000000  40136023  40000000  40000000  40000000  40136023  40136023
000330  40000000  40000000  40000000  40136023  40000000  40136023  40000000  40000000  40000000  40000000  40000000  40000000
000344  40000000  40000000  40136023  40000000  40000000  40000000  40000000  40000000  40000000  40136023  40136023  40136023
000360  40136023  40000000  40000000  40136023  40000000  40136023  40136023  40136023  40136023  40000000  40000000  40136023
000374  40000000  40000000  40000000  40136000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000410  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000424  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000440  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000454  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000470  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000504  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000520  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000534  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000550  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000564  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000600  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000614  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000630  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000644  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000660  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000674  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000710  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000724  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000740  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000754  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000
000770  40000000  40000000  40000000  40000000  40000000  40000000  40000000  40000000

PAUSE AT LOCATION 137776 CPU1  TO READ MORE INPUT

SNAPD 1;013777G,0;0777        .  DEACTIVATE SNAP.
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
REMARK.*********************************************************************
REMARK.*****      LOAD ALL SYSTEM ENVGEN AND K7 MATH PACKAGE      *****.
REMARK.*********************************************************************
ASSIGN PROG=PGM              .  ASSIGN SYSTEM BINARY FILE .
LOADF IM1020,02300           .  LOAD K7 MATH PACKAGE .
LOADF K7ENV1,1               .  LOAD K7 SYSTEM ENVGEN.
REMARK.*********************************************************************
REMARK.*****                SET LOCAL STORAGE LEVELS                 *****
REMARK.*********************************************************************
OCTAL 02000,02156,0          .  LOCAL STORAGE LEVEL 1.
OCTAL 02150,02233,02000      .  LOCAL STORAGE LEVEL 2.
OCTAL 02233,02233,02156      .  LOCAL STORAGE LEVEL 3.
REMARK.*********************************************************************
REMARK.*****              SET ALL DEDICATED INDEX REGISTERS            *****
REMARK.*********************************************************************
PANEL 1,X0=02000,X1=03000,X2=04000,X3=05300,X6=05600,12=00500.    .
PANEL 1,13=06600,14=07200,15=0,PP=01000.  .
STOP 1,0                     .  STOP AT ZERO TO CATCH RUNAWAY PROGRAM .
REMARK.*****  NOTE THAT ALL EXTERNAL DUMMY SYSTEM PROCEDURES          *****
REMARK.*****  START AT LOCATION 0136023.LOCATION 0136024 CONTAINS     *****
REMARK.*****  AN MP INSTRUCTION. PROCEDURE RELESE STARTS AT 0136000   *****
REMARK.*****  TO ALLOW THE USER TO PLACE SNAPS,TRACES,ETC ON THE      *****
REMARK.*****  NOP INSTRUCTIONS FROM 0136000 TO 0136023.     .
OCTAL  0136000,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,043000000. .
REMARK.*********************************************************************
 OCTAL  015015,0. .
    PAUSE  1,0136005     .
    TIME   1,061000,061456,0 .
    SNAP  1,0136004,04054,04054,0   .
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
    SNAP   1,0136005,04267,04267,S  .

    GOTO 1,0136004.

         #CC MEMORY MAP
         **************

 PROGRAM ORIGIN   END    EXECUTE

 SAPB    061000-061460   061000
 TRIG2B  002300-002764   002300

 BAT TABLE: 000000-000377

 CPU1  LOCAL STORAGE : 002000 - 002155
 CPU2  LOCAL STORAGE : 000000 - 000000
 CPU3  LOCAL STORAGE : 000000 - 000000


START #CC SIMULATION

SNAP  REQUEST    PROGRAM ----     FROM 004054 TO 004054 AT LOCATION 136004        PROCESSOR CPU1
004054  -8366008

SNAP  REQUEST    PROGRAM ----     FROM 004267 TO 004267 AT LOCATION 136005        PROCESSOR CPU1
004267-0.2939-38

PAUSE AT LOCATION 136005 CPU1  TO READ MORE INPUT

 ASSIGN  PGM=OBJ.

 LOADF    SAPB,1  .

  COUNT    0,ON .

  GOTO     1,061000    .



START #CC SIMULATION
TIME SNAP     START ADDRESS 061000 TIME        10   /   END ADDRESS 061456 TIME      6590   /   ELAPSED TIME      6580

SNAP  REQUEST    PROGRAM ----     FROM 004054 TO 004054 AT LOCATION 136004        PROCESSOR CPU1
004054          3

SNAP  REQUEST    PROGRAM ----     FROM 004267 TO 004267 AT LOCATION 136005        PROCESSOR CPU1
004267 0.2944+03

PAUSE AT LOCATION 136005 CPU1  TO READ MORE INPUT

  COUNT    OUT .
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

INSTRUCTION COUNTS ALL PROCESSORS

CPUS

INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE
HUP	0	THU	0	IM	9	DM	4	LA1	63	LO1	0	LA2	27	LO2	0	AW	4	SGW	10
CA	1	CL	0	AND	0	SBR	0	OR	0	XOR	0	SZ	1	SP	0	DG1	0	DG2	0
SA1	32	SW1	0	SA2	11	SW2	0	AM	0	SBM	0	MPC	0	BC	1	SRS	0	LRS	0
BMS	0	BML	0	TRD	40	SCN	39	MMC	0	RP	0	FMVA	0	D	0	M	2	CF	0
AIX	0	SAIX	0	LIX	0	SKDX	0	FMVTX	25	FD	6	FM	19	FSA	0	AIA	2	SWIA	2
LIA	2	SAIX	0	FMVFX	25	FA	12	FS	36	AP	1	EFA	0	EFS	0	LCF	19	FR	0
SMF	2	MLC	0	XEC	0		0		0		0		0		0		0		0

TOTAL CPU INSTRUCTIONS EXECUTED 401

CPU1 INDEX REGISTER USAGE NO. OF INDIRECTS 0

X0:	148	X1:	0	X2:	17	X3:	0	X4:	0	X5:	0	X6:	5	X7:	0
X8:	31	X9:	7	10:	0	11:	0	12:	0	13:	0	14:	10	15:	1

```
LOADF  SAPE:2 .

  COUNT   0:0M .

  GOTO   1:0:1000   .


START WCC SIMULATION
TIME SNAP      START ADDRESS 061000 TIME       10  /  END ADDRESS 061456 TIME      7425  /  ELAPSED TIME      7415

SNAP REQUEST   PROGRAM ----   FROM 004054 TO 004054 AT LOCATION 136004      PROCESSOR CPU1
004054         2

SNAP REQUEST   PROGRAM ----   FROM 004267 TO 004267 AT LOCATION 136005      PROCESSOR CPU1
004267 0.2944+03

PAUSE AT LOCATION 136005 CPU1  TO READ MORE INPUT

STOP 1:0136023   .

GOTO 1:0136023   .


START WCC SIMULATION

WCC SIMULATION DONE AT LOCATION 136023 PROCESSOR CPU1
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
INSTRUCTION COUNTS ALL PROCESSORS

CPUS
```

INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE
NOP	7	THU	0	IM	10	UM	11	LA1	74	LQ1	0	LA2	35	LQ2	0	AD	8	SUB	11
LA	0	LL	0	AND	0	SBR	0	OR	0	XOR	0	SZ	1	SP	0	UG1	0	UG2	0
SA1	32	SQ1	0	SA2	11	SQ2	0	AM	0	SBM	0	HPC	0	BC	1	SRS	0	LKS	0
UMS	0	BAL	0	TRU	50	SCN	54	MMC	0	RP	0	FMVA	0	D	0	M	2	CF	0
AIX	0	SBIX	0	LIX	0	SBDX	0	FMVTX	33	FD	6	FM	17	FSQ	0	AIA	2	SRIA	2
LIA	2	SAIX	0	FMVFX	33	FA	10	FS	43	AP	1	EFA	0	EFS	0	LCF	27	FN	0
SOF	6	MLC	0	AEC	0		0		0		0		0		0		0		0

```
TOTAL CPU INSTRUCTIONS EXECUTED        491

CPU1   INDEX REGISTER USAGE        NO. OF INDIRECTS      0
     X0:   179  X1:    0  X2:   15  X3:    0  X4:    0  X5:    0  X6:    5  X7:    0
     X8:    39  X9:    2  10:    0  11:    0  12:    0  13:    0  14:   15  15:    1

TIMING INFORMATION IN .1 MICROSECONDS
*************************************

START ADDRESS 001000      TIME         10
END   ADDRESS 001456      TIME       7425
      LAST PASS ELAPSED TIME         7415
      TOTAL     ELAPSED TIME        13995              2 PASSES


@PRT,I
FURPUR 27R1R RL72-6 04/25/78 15:29:55
SPRUELL*TPFS(0),F17,T
SPRUELL*SAPB(1),F2,C  PROG,
EU*CC(1),F2,AA
K70C*COMPOOL(1),F2,A  COMPOOL,
SPRUELL*LIBRARY(0),F4,T
SPRUELL*TEMPED(0),F4,T
EU*OPTGL(1),F2,AA
SPRUELL*INTERPASS(0),F4,T
EU*A*BIN(1),F2,A  PGM,
SPRUELL*EOBJIT(0),F4,T  EOBJ,ASMSOURCE,
SPRUELL*ESRCE(0),F4,T
EU*A*DRIVER(1),F2,A
SPRUELL*CALLSOUT(0),F4,T
EU*SIMACC2(1),F2,A  CSINTNAMES,

@FIN
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```
[illegible]: MSWAM     ACCT: 000WPRH0000     PROJECT: SPHWELL
TIME:     TOTAL: 00:05:07.503
          CPU:   00:00:37.214     I/O:  00:03:20.376
          CC/ER: 00:01:09.913     WAIT: 00:00:00.050
IMAGES READ:   706          PAGES:  71
START:    15:11:24 APR 25,1978    FIN:  15:29:59 APR 25,1978
```

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